PROPOSED HAUL CANE ROAD IN WAIPAHU FROM INTERSTATE H-1 TO AUALII STREET PRELIMINARY SOIL REPORT

WAIKELE, EWA, OAHU, HAWAII

To:
COMMUNITY PLANNING, INCORPORATED

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

December 29, 1971

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

WALTER LUM
EDWARD WATANABE
EZRA KOIKE

3030 WAIALAE AVE., HONOLULU, HAWAII 96816 • TEL. 737-7931

December 29, 1971

MR. GEORGE HOUGHTAILING
Community Planning, Inc.
Suite 608, 700 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Houghtailing:

Subject: Proposed Haul Cane Road in Waipahu
From Interstate H-1 to Aualii Street
Preliminary Soil Report
(for pavement design purposes)
Waikele, Ewa, Oahu, Hawaii

In accordance with your request, soil explorations were made to determine general soil conditions at the Proposed Haul Cane Road in Waipahu, from Interstate H-1 to Aualii Street, Waikele, Ewa, Oahu, Hawaii.

The proposed plan is to relocate an existing haul cane road. The northern section of the proposed route is located partly along the existing haul cane road. The central section crosses an old gully or drainageway, and the southern section crosses an area occupied by existing plantation homes.

The surface soils may be generally described as stiff reddish-brown clayey silts and silty clays (ML-MH soils) about 4 to 19 ft thick underlain by decomposed rocks to about 16 to 40 ft, the maximum depths drilled.

Preliminary plans indicate cuts of about 10 to 30 ft in the northern section; fills of about 5 ft in the central sections; and shallow cuts in the southern section.

General recommendations follow:

Cut and fill slopes should be made at 2 horizontal to 1 vertical slope ratio.

Before fills are constructed across the drainageway floor, subdrains should be installed along the bottom of the drainageway.

The subgrade should be compacted and shaped to drain.

The pavement section should include about 1 in. of asphaltic concrete, 6 in. of base course (CBR > 80), 6 in. of subbase (CBR > 50), and 12 in. of select borrow (CBR > 25).

Soft spots, clayey soils or unforeseen conditions may occur in localized areas and will have to be adjusted and corrected in the field as they are detected.

The earthwork should be done in accordance with the requirements of Chapter 23, Revised Ordinances of Honolulu, 1961 As Amended and the recommendations contained herein.

The report includes a Boring Location Plan, boring logs, laboratory test results, recommendations and limitations.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

Ezra Koike

Ezra Koike
Professional Engineer
Hawaii No. 1450

EK:vl

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PROPOSED HAUL CANE ROAD IN WAIPAHU
FROM INTERSTATE H-1 TO AUALII STREET
PRELIMINARY SOIL REPORT

WAIKELE, EWA, OAHU, HAWAII

SCOPE OF EXPLORATION

The purpose of this exploration was to determine general soil conditions for the Proposed Haul Cane Road in Waipahu, Waikele, Ewa, Oahu, Hawaii.

This report includes field explorations, laboratory tests and general design recommendations for cuts and fills and the general pavement section.

FIELD EXPLORATION

Five exploratory borings were made at the site. The approximate locations of these borings are shown on the Boring Location Plan. Descriptions of the underlying soils encountered are shown on Boring Logs Nos. 1 thru 5. Also attached is a log of boring from a previous report, "Proposed Fill Area in Waipahu, Adjacent to the Proposed Relocated Haul Cane Road."

Borings were made with 3, 4 and 6-in. diameter augers using a carbide drag bit. Soil samples were recovered with 2-in. thin-wall tube samplers and a standard split spoon sampler driven with a 140-lb hammer falling 30 inches.

LABORATORY TESTS

Laboratory tests included: natural water content, Atterberg limit, expansion and CBR.

A summary of the laboratory test results is given in Tables IA thru IC.

SOIL CLASSIFICATION SYSTEM

Soil samples were visually observed and subjected to appropriate tests in the laboratory. Based on visual observations and laboratory tests, the soil descriptions given on the boring logs are generally made in accordance with the "Unified Soil Classification System."

GENERAL SITE CONDITIONS

The proposed Haul Cane Road is to be located on the south side of the Interstate H-1 freeway and extends in a southerly direction to Aualii Street for a distance of about 2,200 ft.

The proposed plan is to relocate an existing haul cane road. The northern section of the proposed route is located partly along the existing haul cane road. The central portion crosses an old gully or drainageway, and the southern section crosses an area occupied by existing plantation homes.

The natural drainageway slopes downward in a southeasterly direction at about a 2% gradient. The side slopes vary from about 8 to 15%.

An existing silting basin was noted about 150 ft east of the proposed roadway near the southern section of the alignment.

INTERPRETATION OF SOIL CONDITIONS

From the field exploration and laboratory test results, the soils may be generally described as follows:

> Stiff reddish-brown clayey silts and silty clays (ML-MH soils) to about 4 to 19-ft depths, underlain by decomposed rocks to about 16 to 40 ft, the depths drilled.

Water was not noted in the borings during the field explorations.

For more detailed descriptions of soils encountered in the borings, refer to the boring logs.

DISCUSSION AND RECOMMENDATIONS

In general, the present plan is to relocate the existing haul cane road between the Interstate H-1 Freeway and Aualii Street.

Preliminary plans indicate cuts of about 10 to 30 ft in the northern section; fills of about 5 ft in the central section; and shallow cuts in the southern section.

Before fills are constructed across the drainageway, loose surface soils should be stripped. Trenches should be cut in a herringbone pattern and subdrains placed in the trenches to provide drainage paths for the bottom of the drainageway.

Cesspools may be encountered near the existing plantation homes. They should be located on the Grading Plan prior to grading operations, if practicable. Sludge should be removed and the cesspool backfilled with granular material.

Decomposed rocks were encountered at about 5-ft depths in some borings. Because of the shallow depths to decomposed rocks, boulders will probably be found interspersed over the site. The closer an excavation approaches decomposed rocks, the greater will be the quantity of boulders. Boulders may be used to construct the toes of fill slopes, see Figure 1.

Site Grading

Surface vegetation, ditch linings and miscellaneous debris should be cleared and removed prior to site filling. Localized soft pockets encountered during the site preparations should be excavated and backfilled with compacted select material. Provisions to drain the site should be included during and after the completion of filling operations.

In general, the on-site soils and approved borrow soils may be used for the construction of the proposed fills. Grading work should be done according to the Revised Ordinances of Honolulu, 1961 As Amended; and as recommended below:

1. The area should be cleared and grubbed.

2. Topsoil and stockpiled soils should be either (a) stripped to stiff natural ground or (b) scarified and recompacted before the placement of fills.

3. The bottom and sides of irrigation ditches should be stripped down to stiff natural ground or scarified and recompacted before the placement of fills.

4. Hard surfaces along existing haul roads should be scarified down to stiff soils and recompacted to match the density of the surrounding soil.

5. Thin sidehill fills (sliver fills) on sloping areas should be avoided.

6. Where fills are proposed in sidehill areas, gullies and along drainage and irrigation ditches, loose material along the bottom and sides should be stripped down to stiff natural ground or scarified and recompacted before the placement of fills. New fills should be keyed into the stiff natural ground.

7. Subdrains should be placed in a herringbone pattern along the bottom and sides of natural drainageways or dips before the placement of fills. The locations of subdrains should be determined in the field after clearing and grubbing.

8. Fills should be constructed in approximately level layers starting at the lower end and working upward. Where fills are made on sloping areas steeper than about 5 horizontal to 1 vertical, the ground at the toe of the fill should be benched to a generally level condition. As the fill is brought up, it should be keyed continually into the stiff natural ground by cutting steps into the slopes and compacting the fill into these steps.

9. Fills should be laid in 6-in. compacted layers to 90% of the maximum density determined by the AASHO T-180-57 test method.

Existing Cesspools

Cesspools possibly may be encountered during the site preparation work where the plantation homes are located. When encountered, they should be flagged and located on the plans. Sludge should be removed from the bottom of each cesspool and replaced with fairly well-graded granular materials. The materials should be placed in thin layers and rammed into place or compacted with vibratory equipment. The top 5 ft of fill should be compacted in 6-in. compacted layers.

Building foundations should be designed to bridge over the cesspool.

Slopes

In general, cut and fill slopes of 2 horizontal to 1 vertical or flatter should be used.

For slope heights (top to toe) greater than about 20 ft, 8-ft-wide benches should be placed at about 15-ft height intervals.

To minimize erosion, the runoff from rainstorms should be diverted by berms or ditches away from slopes whenever practicable.

The surface of fill slopes should be compacted by cat-tracking or with a sheepsfoot roller.

Slope planting is recommended on cut and fill slopes to minimize erosion.

Slope adjustments or other precautions may be necessary if seepage zones or soft spots are encountered in localized areas.

Roadway

In general, a rough estimate of the roadway pavement thickness for the cane hauling trucks is as follows:

1. Wearing course - 1-in. asphaltic concrete.
2. Base course - 6-in. base course, CBR $>$ 80.

3. Subbase course - 6-in. subbase course, CBR > 50.

4. Select borrow - 0-in. select borrow over rocky ground.

12-in. select borrow, CBR > 25, over silty clay soils.

Provisions should be made in the contract documents to allow for local adjustments regarding subbase requirements in the field. In fill areas, the use of select soils within the top 2 to 3 ft of the subgrade may reduce the thickness or eliminate the need for the subbase course.

The subgrade should be compacted and shaped to drain. To avoid the ponding of water and softening of the subgrade at low points, weep holes should be placed at subgrade levels thru the walls of the catch basins which are placed in these low areas.

Utilities

Utilities should be placed after the fills are constructed. Utility lines should be designed with flexible joints, particularly where lines are connected to structures.

Unforeseen Conditions

Unforeseen or undetected conditions such as soft spots and abandoned utilities may occur in localized areas and will have to be adjusted and corrected in the field as they are detected.

BORING LOGS

The stratification lines shown on each of the boring logs represent the approximate boundary between soil types and the transition may be gradual.

Symbols

Symbols used generally are in accordance with the Unified Soil Classification System.

Where a parenthesis "(MH)" is used, the soil sample was classified by visual observation of the sample recovered.

Where no parenthesis "MH" is used, the soil sample was classified from either the Atterberg limit or sieve analysis test results.

CANE HAUL ROAD

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: PROPOSED HAUL CANE ROAD IN WAIPAHU

LOCATION: From Interstate H-1 to Aualii St.
Waikele, Ewa, Oahu, Hawaii

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 1 Sheet No. ____ of ____

Driller: W. LUM ASSOC., INC. Date: OCT. 15, 1971

Field Party: MAKAULA, ASATO, COLLURA

Type of Boring: AUGER (MOBILE B-40) Diam.: 6" (HOLLOW STEM)

Elev.: 119'±* Datum: —

Drill Bit: T.C. DRAG

Water Level	NOT NOTICED			
Time	1:00 PM			
Date	10-15-71			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 119'±*	0								
MH	STIFF, REDDISH BROWN CLAYEY SILT	5		1-A	-	32	-	-	-	
				1-B	-	31	-	-	-	
		10		1-C	30	28	53	—	-	47
		15		1-D	-	42	-	-	-	33/4" HAMMER BOUNCES
	GRAY BROWN DECOMPOSED ROCK	20		1-E	-	30	-	-	-	33/3"
		25		1-F	-	35	-	-	-	40/5"
		30		1-G	-	22	-	-	-	40/5"

END OF BORING @ 30.5'

* ELEVATION ESTIMATED FROM PROFILE DATED AUG. 10, 1971

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: PROPOSED HAUL CANE ROAD IN WAIPAHU
LOCATION: From Interstate H-1 to Aualii St.
Waikele, Ewa, Oahu, Hawaii

HAMMER:
Weight: 140#
Drop: 30"
SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 2 Sheet No. ____ of ____
Driller: W. LUM ASSOC., INC. Date: OCT. 15 & 16, 1971
Field Party: MAKAULA, ASATO, COLLURA, GLORY
Type of Boring: AUGER (MOBILE B-40) Diam.: 6" (HOLLOW STEM)
Elev.: 118'± * Datum: —
Drill Bit: T.C. DRAG

Water Level				
Time	—			
Date	10-16-71			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 118'± *	0							
ML			2-A	28	31	44	-	-	
MH	STIFF, REDDISH BROWN CLAYEY SILT	5	2-B	16	32	52	-	-	
		10	2-C	-	35	-	-	-	
	MOTTLED GRAY BROWN DECOMPOSED ROCK	15	2-D	-	34	-	-	-	
	GRAY, BOULDER OR ROCK	20	2-E	-	-	-	-	-	31/.1'
	GRAY, DECOMPOSED ROCK	25	2-F	-	36	-	-	-	30/.3'
	BOULDER OR ROCK FORMATION	30	2-G	-	6	-	-	-	30/.1'
		35	2-H	-	NO	RECOVERY	-		20/.0'
	BROWNISH GRAY DECOMPOSED ROCK (PUKA PUKA)	40	2-I	-	17	-	-	-	10/.1'
	END OF BORING @ 40.6'								

*ELEVATION ESTIMATED FROM PROFILE DATED AUG. 10, 1971

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: PROPOSED HAUL CANE ROAD IN WAIPAHU

LOCATION: From Interstate H-1 to Aualii St. Waikele, Ewa, Oahu, Hawaii

HAMMER: Weight 140# Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 3 Sheet No. ____ of ____

Driller W. LUM ASSOC., INC. Date OCT. 22, 1971

Field Party MAESHIRO, KAKU, RADOVICH

Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"

Elev. 75'± * Datum —

Drill Bit T.C. DRAG

Water Level				
Time	—			
Date	10-22-71			

Unified Soil Classification	DRILL RATE	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40
		ELEV. = 75'± *	0								
ML		MEDIUM, REDDISH BROWN CLAYEY SILT W/TRACES OF ASH & ROOTS			3-A	29	32	46	-	-	
MH		STIFF, BROWN CLAYEY SILT & DECOMPOSED ROCK	5		3-B	36	41	57	-	-	30/.2'
	5'-10' 45 MIN.	COBBLES OR BOULDERS									
		MOTTLED BROWN DECOMPOSED ROCK	10		3-C	-	32	-	-	-	30/.5'
	10'-15' 35 MIN.	COBBLE OR BOULDER									
		MOTTLED BROWN DECOMPOSED ROCK									
		END OF BORING @ 16'	15		3-D	-	35	-	-	-	32/.5'

*ELEVATION ESTIMATED FROM PROFILE DATED AUG. 10, 1971

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: PROPOSED HAUL CANE ROAD IN WAIPAHU
LOCATION: From Interstate H-1 to Aualii St.
Waikele, Ewa, Oahu, Hawaii

HAMMER:
Weight: 140#
Drop: 30"
SAMPLER: 2" SS - 2" O.D. THIN WALL TUBE
2" SS - 2" STANDARD SPLIT SPOON

BORING NO. 4 Sheet No. ____ of ____
Driller W. LUM ASSOC., INC. Date OCT. 15, 1971
Field Party SUZUKI, RADOVICH, MAESHIRO, KAKU
Type of Boring AUGER (ACKER & B-30 ACE) Diam. 3"
Elev. 82'± * Datum —
Drill Bit T.C. DRAG

Water Level				
Time	—			
Date	10-16-71			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
	ELEV. = 82'± *	0									
(MH)	STIFF, REDDISH BROWN CLAYEY SILT		2"SS	4-A	-	21	-	-	-		
(MH)	MEDIUM, REDDISH BROWN CLAYEY SILT	5	2"SS	4-B	-	-	-	-	-		75/.5'
	ROCK OR BOULDER										
	MEDIUM, REDDISH BROWN CLAYEY SILT	10	2"S	4-C	-	21 (UNABLE TO EJECT SAMPLE)	-	-	-		8/.5' 14/.5'
	STIFF, LIGHT BROWN CLAYEY SILT										
(MH)	STIFF, MOTTLED REDDISH BROWN, SILTY CLAY	15	2"SS	4-D	-	23	-	-	-		26/.5'
ML	STIFF, BROWN CLAYEY SILT & TRACES OF DECOMPOSED ROCK	20	2"SS	4-E	32	30	42	-	-		28/.5'
	STIFF REDDISH BROWN & BROWN CLAYEY SILT & DECOMPOSED ROCK	25	2"SS	4-F	-	38	-	-	-		40/.5'
	BOULDER	30	2"SS	4-G	-	-	-	-	-		50/.0' HAMMER BOUNCES

* ELEVATION ESTIMATED FROM PROFILE DATED AUG. 10, 1971

CANE HAUL ROAD

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT PROPOSED HAUL CANE ROAD IN WAIPAHU

LOCATION From Interstate H-1 to Aualii St.
Waikele, Ewa, Oahu, Hawaii

HAMMER:
Weight 140#
Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 5 Sheet No. ____ of ____
Driller W. LUM ASSOC., INC. Date OCT. 21, 1971
Field Party MAESHIRO, KAKU, RADOVICH
Type of Boring AUGER (MOBILE B-30) Diam. 4"
Elev. 68'± * Datum —
Drill Bit T.C. DRAG

Water Level					
	NOT NOTICED				
Time	—				
Date	10-21-71				

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 68'± *	0								
	BROWN, SILTY CLAY W/GRAVEL & CORAL (FILL)									
ML	MEDIUM, BROWN CLAYEY SILT W/TRACES OF ASH			5-A	-	34	-	-	-	
ML	STIFF, BROWN CLAYEY SILT W/TRACES OF DEC. ROCK	5		5-B	-	31	-	-	-	
(MH-CH)	STIFF, BROWN & GRAY SILTY CLAY W/TRACES OF DECOMPOSED ROCK	10		5-C	-	28	-	-	-	
		15		5-D	-	38	-	-	-	30/.3'
	GRAY BROWN DECOMPOSED ROCK	20		5-E	-	35	-	-	-	30/.2'
		25		5-F	-	34	-	-	-	35/.3'
	BROWN DECOMPOSED ROCK	30		5-G	-	30	-	-	-	60/.4'
	END OF BORING @ 30.4'									
	* ELEVATION ESTIMATED FROM PROFILE DATED AUG. 10, 1971									

STIFF DRILLING

PROPOSED HAUL CANE ROAD IN WAIPAHU

TABLE I A - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	1		2	2
SAMPLE NO.	C			B
DEPTH BELOW SURFACE	10.0'-11.5'		SURFACE	5.0'-6.5'
DESCRIPTION	REDDISH BROWN CLAYEY SILT		REDDISH BROWN CLAYEY SILT	REDDISH BROWN CLAYEY SILT
GRAIN-SIZE ANALYSIS (% Passing) Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL		NATURAL	NATURAL
Liquid Limit	53		44	52
Plastic Limit	30		28	36
Plasticity Index	23		16	16
Dilatancy	QUICK		QUICK	QUICK
Toughness	MEDIUM		SLIGHT-MEDIUM	SLIGHT-MEDIUM
Dry Strength	SLIGHT-MED.		SLIGHT-MED.	SLIGHT
UNIFIED SOIL CLASSIFICATION	MH		ML	MH
APPARENT SPECIFIC GRAVITY				
EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %			27.5	
Molding Dry Density, P.C.F.			95.1	
Swell upon saturation, %			0.6	
CBR at 0.1" Penetration			5.1	
MOISTURE-DENSITY RELATIONS OF SOILS (AASHO T-180-57 Method ___)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 12-6-71 By C.R.

PROPOSED HAUL CANE ROAD IN WAIPAHU

TABLE I B - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	3	3		4
SAMPLE NO.	A	B		E
DEPTH BELOW SURFACE	1.5'-3.0'	5.0'-5.7'		20.0'-21.0'
DESCRIPTION	REDDISH BROWN CLAYEY SILT W/TRACES OF ASH & ROOTS	BROWN CLAYEY SILT & DECOM. ROCK		BROWN CLAYEY SILT & TRACES OF DECOM. ROCK
GRAIN-SIZE ANALYSIS (% Passing) Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL		NATURAL
Liquid Limit	46	57		42
Plastic Limit	29	36		32
Plasticity Index	17	21		10
Dilatancy	MEDIUM	MEDIUM		QUICK
Toughness	MEDIUM	MEDIUM		SLIGHT-MEDIUM
Dry Strength	SLIGHT-MED.	SLIGHT-MED.		SLIGHT
UNIFIED SOIL CLASSIFICATION	ML	MH		ML
APPARENT SPECIFIC GRAVITY				
EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %				
Molding Dry Density, P.C.F.				
Swell upon saturation, %				
CBR at 0.1" Penetration				
MOISTURE-DENSITY RELATIONS OF SOILS (AASHO T-180-57 Method ___)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 12-6-71 By C.R.

PROPOSED HAUL CANE ROAD IN WAIPAHU

TABLE I C - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	5	5		
SAMPLE NO.	A	B		
DEPTH BELOW SURFACE	1.5-3.0'	5.0'-6.5'		
DESCRIPTION	BROWN CLAYEY SILT W/TRACES OF ASH	BROWN CLAYEY SILT W/TRACES OF DECOM. ROCK		
GRAIN-SIZE ANALYSIS (% Passing)				
Sieve 1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL		
Liquid Limit	48	48		
Plastic Limit	29	31		
Plasticity Index	19	17		
Dilatancy	MEDIUM	MEDIUM-QUICK		
Toughness	MEDIUM	MEDIUM		
Dry Strength	SLIGHT-MED.	SLIGHT-MED.		
UNIFIED SOIL CLASSIFICATION	ML	ML		
APPARENT SPECIFIC GRAVITY				
EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %				
Molding Dry Density, P.C.F.				
Swell upon saturation, %				
CBR at 0.1" Penetration				
MOISTURE-DENSITY RELATIONS OF SOILS (AASHO T-180-57 Method ___)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

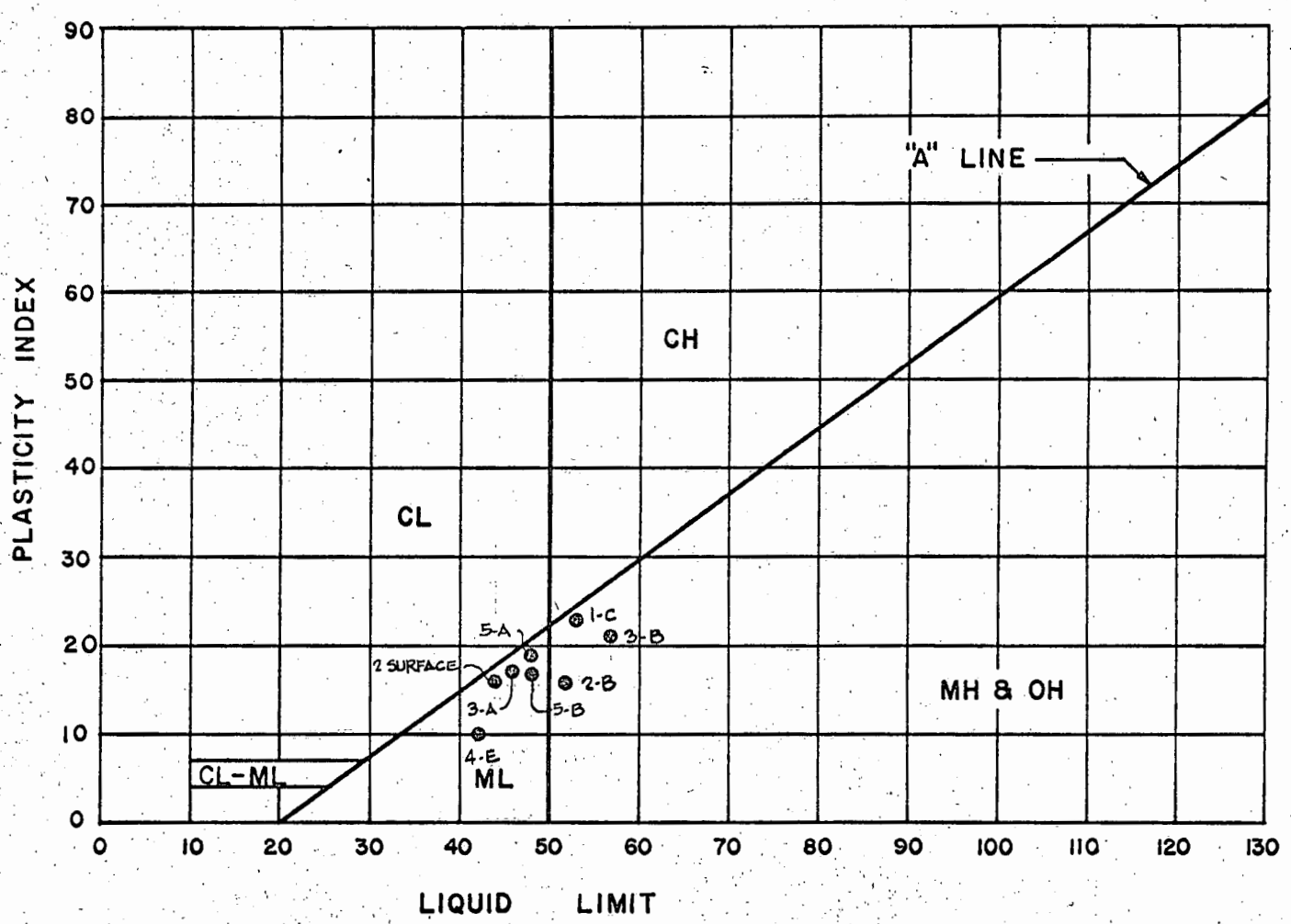
WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 12-6-71 By C.R.

PLASTICITY CHART

PROJECT: PROPOSED HAUL CANE ROAD IN WAIPAHU

LOCATION: FROM INTERSTATE H-1 TO AUALII ST.
WAIKELE, EWA, OAHU, HAWAII



DATE 11-27-71 BY C.R.

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

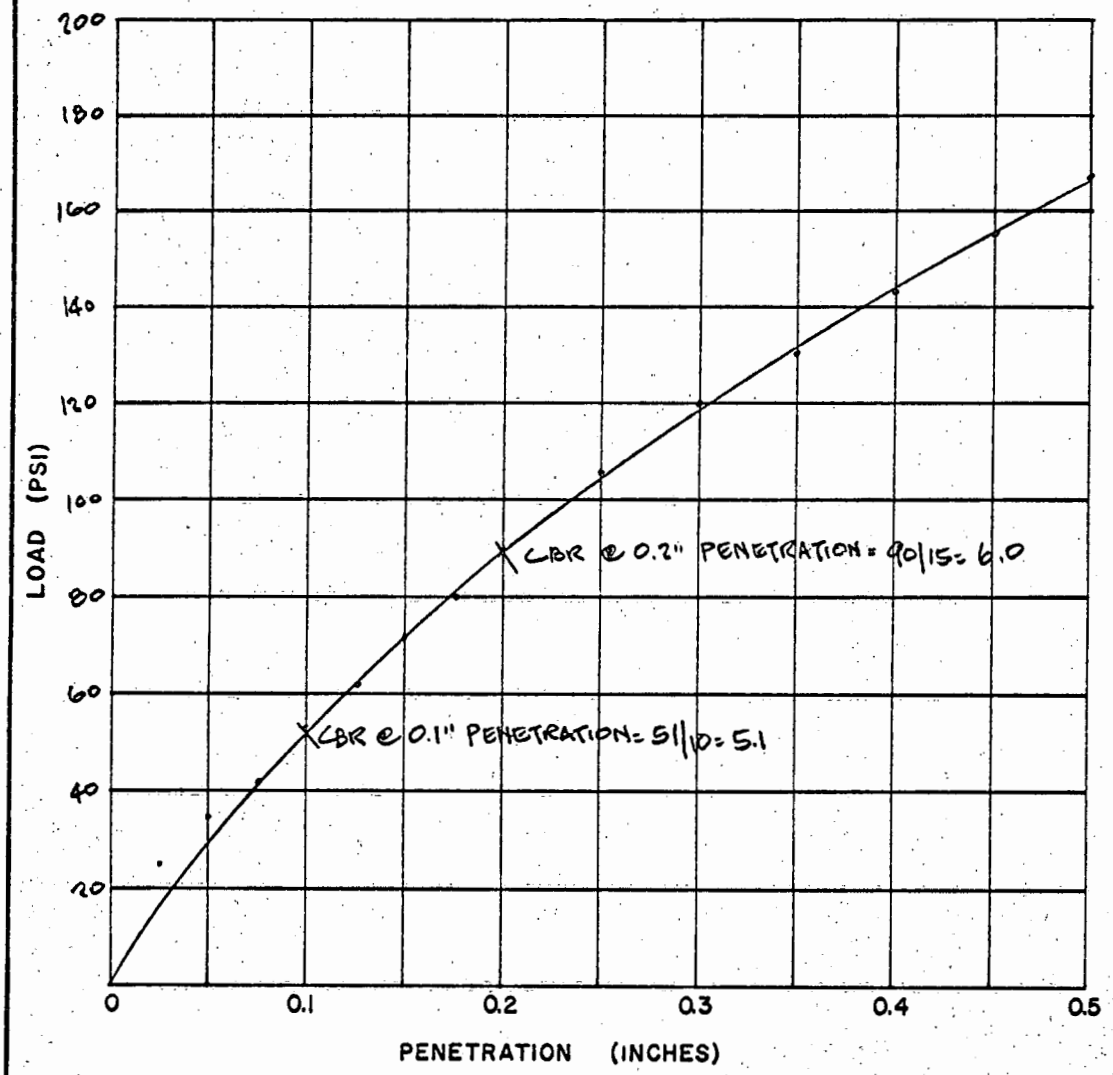
CBR TEST

PROJECT: PROPOSED HAUL CANE ROAD IN WAIPAHU

LOCATION: FROM INTERSTATE H-1 TO AUALII ST. WAIKELE, EWA, OAHU, HAWAII

SAMPLE NO: 2 SURFACE

SAMPLE DESCRIPTION: REDDISH BROWN, CLAYEY SILT



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	75	25
0.050	105	35
0.075	125	42
0.100	160	53
0.125	185	62
0.150	215	72
0.175	240	80
0.200	270	90
0.250	315	105
0.300	360	120
0.350	390	130
0.400	430	143
0.450	465	155
0.500	500	167

AGGREGATE ¼" MINUS

HAMMER WEIGHT 10 LBS.

HAMMER DROP 18"

No. OF BLOWS 56

No. OF LAYERS 5 LAYER

TEST RESULTS:

MOLDING MOISTURE, %. 27.5

MOLDING DRY DENSITY, P.C.F. 95.1

CBR @ 0.1" PENETRATION 5.1

DAYS SOAKED 4

DATE 10-19-71 BY BS

DATE 10-25-71 BY SK

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

LOG OF BORING

FROM

PROPOSED FILL AREA IN WAIPAHU

(DATED DECEMBER 6, 1971)

WAIPAHU - PROPOSED FILL AREA

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: PROPOSED FILL AREA IN WAIPAHU ADJACENT TO THE PROPOSED RELOCATED HAUL CANE ROAD

LOCATION: Ewa, Oahu, Hawaii

Tax Map Key: 9-4-02: Por. 5

HAMMER: Weight 140# Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 7 Sheet No. ____ of ____

Driller W. LUM ASSOC., INC. Date SEPT. 13, 1971

Field Party MAESHIRO, MEYER

Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"

Elev. 83' ± * Datum —

Drill Bit T.C. DRAG

Water Level NOT NOTICED

Time —

Date 9-13-71

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 83' ±*	0								
ML-CL	MEDIUM TO STIFF REDDISH BROWN, SILTY CLAY			7-A	-	30	-	-	-	
					PL=	27				
					LL=	47				
ML	STIFF, REDDISH BROWN SILTY CLAY	5		7-B	-	28	-	-	-	
					PL=	28				
					LL=	46				
	BOULDER OR ROCK FORMATION	10								
	END OF BORING @ 9'									
	NOTE: MOVED BORING 5' AWAY AND HIT BOULDER AT 10'.									

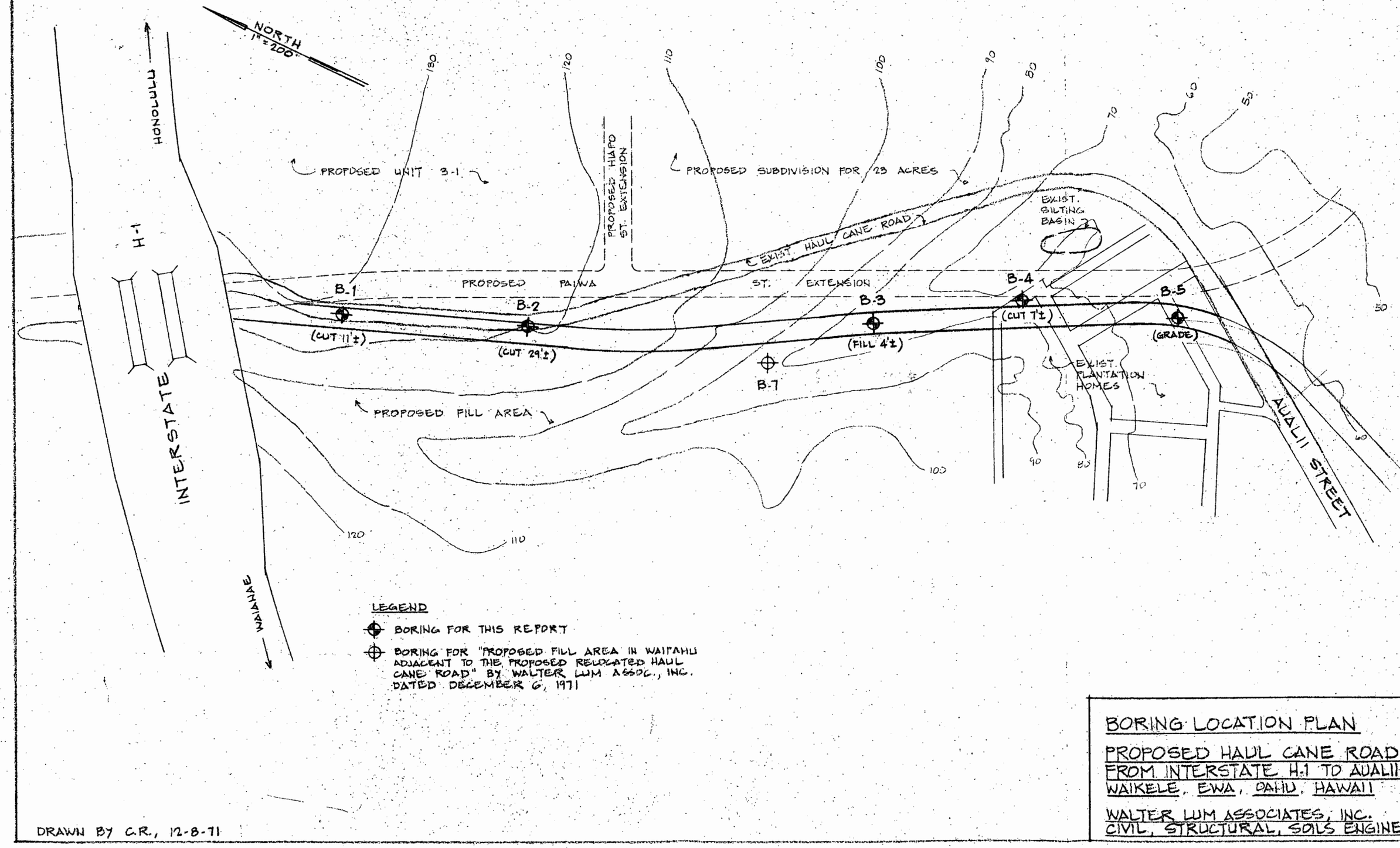
* ELEVATION ESTIMATED FROM CONTOUR MAP

LIMITATIONS

In general, soil formations are commonly erratic and rarely uniform or regular. The boring logs indicate the approximate subsurface soil conditions encountered only at the drill holes where the borings were made at the times designated on the logs and may not represent conditions at other locations or at other dates. Soil conditions and water levels may change with the passage of time and construction methods or improvements at the site.

During construction, should subsurface conditions much different from those in the borings be observed, encountered, or otherwise indicated, we should be advised immediately to review or reconsider our recommendations in light of the new developments.

Our professional services were performed, findings obtained and recommendations prepared in accordance with generally accepted engineering practices. This warranty is in lieu of all other warranties expressed or implied.

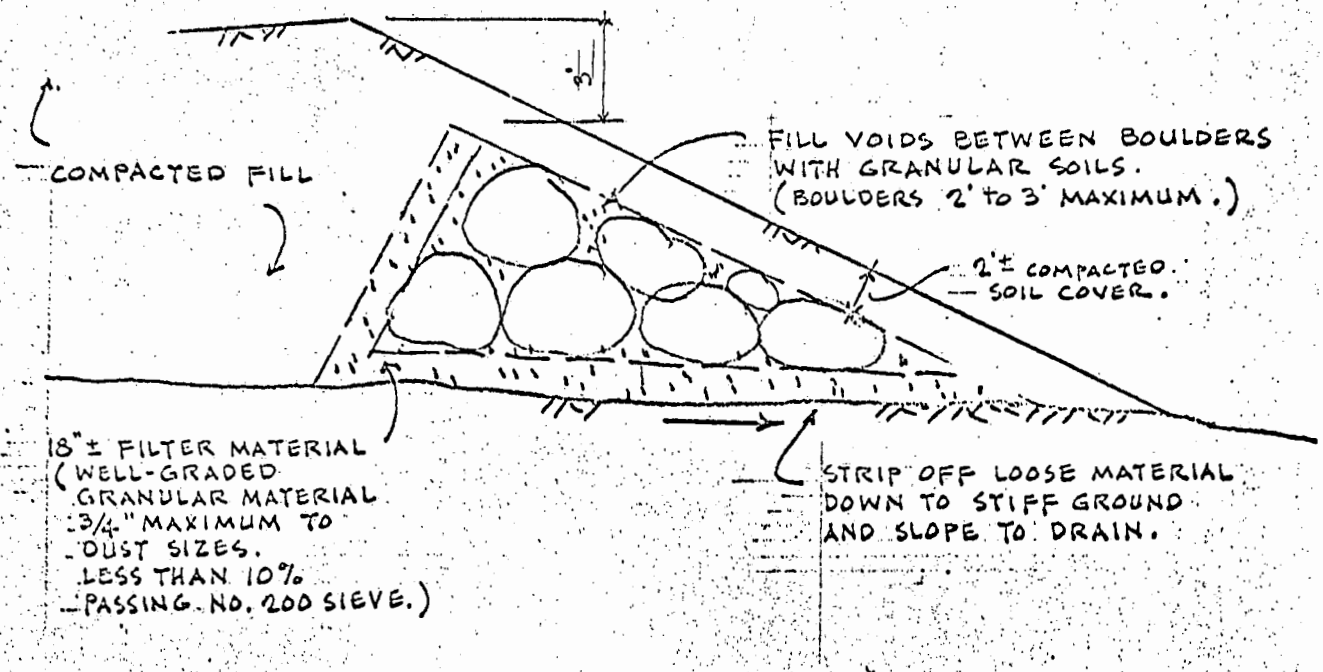


DRAWN BY C.R., 12-8-71

BORING LOCATION PLAN

PROPOSED HAUL CANE ROAD
FROM INTERSTATE H-1 TO AUALII ST.
WAIKELE, EWA, OAHU, HAWAII

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS



SECTION

NOT TO SCALE

FIGURE 1

PROPOSED BOULDER FILL

PROPOSED CANE HAUL ROAD

IN WAIPAHU

FROM INTERSTATE H-1 TO AUALII ST.

WAIKELE, EWA, OAHU, HAWAII

WALTER LUM ASSOCIATES, INC.

CIVIL, STRUCTURAL, SOILS ENGINEERS

12/10/71